

B. K. NAYAR\*: **On the gametophytes of**  
*Pleurosoriopsis makinoi*

B. K. ナヤール\*: カラクサンダの配偶体について

In a recent publication in this journal (Journ. Jap. Bot. Vol. 50) Shigeo Masuyama (1975) published an account of the gametophyte of the taxonomically controversial Japanese genus *Pleurosoriopsis* Fomin. He concluded that most of the several characteristic features of the gametophyte are associated with the rupicolous habit of the sporophyte and thus of little phylogenetic value, except the nature of the prothallial hairs, which according to him indicate some affinity to the Polypodiaceae. This appears to be a gross understatement. From the account of prothallial morphology given by Masuyama, it is obvious to any one who has long experience with gametophytes of leptosporangiate ferns, that the gametophyte morphology of *Pleurosoriopsis* indicates close affinity with Polypodiaceae. This is all the more interesting since sporophyte of *Pleurosoriopsis*, probably on account of its extreme simplicity, does not give sufficient clues to its affinities, as is evident from the totally unconnected taxonomic positions attributed to the genus by contemporary taxonomists (included by Christensen, 1938 and Ching, 1940 in Aspleniaceae; by Copeland, 1947 in Pteridaceae; by Holttum, 1947 in Gymnogrammaceae). The unequivocally Polypodiaceous affinity of *Pleurosoriopsis* as evidenced by gametophyte morphology is brought out below.

The spores of *P. makinoi* (Maxim.) Fomin are of the monolete type devoid of perine as in Polypodiaceae whereas the spores of Pteridaceae as well as the Gymnogrammaceae (Nayar and Devi, 1966, 1967) are distinctly of the trilete type, and those of the Aspleniaceae (Nayar & Devi, 1964) though monolete are provided with characteristic perine. Spore germination, by the development of a transversely elongated germ filament (with no distinction between the two ends of the filament) formed by a series of divisions by walls parallel to the polar axis of the spore and devoid of a primary rhizoid, is characteristic of *Christiopteris* (Nayar, 1967a). As in *P.*

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*makinoi* the spores of *Christiopteris* are monolete, non-perinate, chlorophyllous and markedly elongated along the equatorial axis. Also, they germinate before they are shed from the sporangia, so that at shedding the spores are often 2-4 celled; all cells produced by the first few divisions of the spore are equal, resulting in a primary filament without any rhizoid and elongated along the equatorial axis of the spore, with both the ends similar. Such a condition is not found in any other fern, though as pointed out earlier (Nayar & Kaur, 1968) is probably derived from the Gleicheniaceae stock. In all Aspleniaceae, Pteridaceae and Gymnogrammaceae spore germination is of the Vittaria-type (by the formation of a wall perpendicular to the polar axis of the spore, cutting off a small rhizoid initial at the proximal pole, followed by divisions in the larger cell by walls perpendicular to the first wall). In all the Polypodiaceae the early rhizoids are brownish in color as in *P. makinoi*: this character is not found in the asplenioid, pteridoid and gymnogrammoid ferns.

Prothallial development of *P. makinoi* is typically of the Kaulinia-type (Nayar & Kaur, 1969) as in *Christiopteris* and other Polypodiaceae possessing ribbon-shaped prothalli (Nayar & Kaur, 1971). None of the asplenioid, pteridoid and gymnogrammoid ferns possess such development pattern. The perennial, branched, ribbon-like adult prothallus of *P. makinoi* devoid of a distinct apical meristem and midrib, and bearing profuse marginal rhizoids and sex organs on small superficial cushions is characteristic of *Christiopteris* and several other Polypodiaceae (especially of *Kaulinia* and its derivatives) as also the closely related family Loxogrammaceae (Nayar, 1967b). Such prothalli are found in the Vittariaceae but are not reported in any Aspleniaceae, Pteridaceae or Gymnogrammaceae. Vegetative propagation by means of prothallial gemmae as found in *P. makinoi* is found in the Polypodiaceous genera but occurs in all ferns having ribbon-shaped perennial prothalli. The multicellular prothallial trichomes bearing unicellular papillate branches on the penultimate cells are distinctly of the Polypodiaceous type, as pointed out by Masuyama. However, similar prothallial hairs are found in some other groups of leptosporangiate ferns as well, and may not indicate affinity if considered in isolation. But in conjunction with the other similarities as enumerated above, the Polypodiaceous hairs of *P. makinoi* gain significance. In contrast, the prothalli of the pteridoid- and

gymnogrammoid ferns are characteristically naked (Nayar & Kaur, 1971). Even though possessing ribbon-like prothalli, the vittarioid ferns (which are regarded as gymnogrammoid derivatives) also possess naked prothalli. The Aspleniaceae include taxa which have naked prothalli as well as those bearing glandular hairs (Momose, 1959-62). However, the prothallial hairs of Aspleniaceae do not resemble Polypodiaceous hairs.

Prothallial morphology thus indicates that *Pleurosoriopsis* is a polypodiaceous fern and is not related to the Pteridaceae, Gymnogrammeaceae or Aspleniaceae. It seems to be close to *Christiopteris* and *Kaulinia* both of which as well as the kaulinioid derivatives are terrestrial ferns like *Pleurosoriopsis*. The non-indusiate, elongated, superficial sori and creeping rhizome of *Pleurosoriopsis* (Copeland, 1947) support this. Further confirmation of affinities can be had from chromosome counts and perhaps also from the nature of the juvenile leaves of *Pleurosoriopsis* (the Polypodiaceae possess simple, narrow, entire, juvenile lamina supplied by a single usually unbranched vein; a midrib is established by unequal dichotomy of the vein followed by overtopping: in the asplenioid, pteridoid and gymnogrammoid ferns the juvenile lamina is short, broad and supplied by a repeatedly dichotomized vein; a midrib is formed as a separate branch originating from the base of one of the primary branch veins of the first dichotomy).

### References

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本誌 50: 105-114 (1975) に益山樹生氏がカラクサンダの配偶体についての立派な観察結果を報告している。益山氏は特有の毛以外の諸形質はすべて孢子体の岩上生という生態に関連しているもので、系統的価値は認められないといっているが、20年以上配偶体を扱っている私には大いに異論がある。すなわち益山氏発表の配偶体の形態からみると、カラクサンダはウラボシ科特に *Christiopteris* (東南アジア方面に数種知られた中形のシダ) と類縁が深い。周皮を持たない両面体の孢子、発芽の際の様子、初期の仮根が褐色を帯びること、前葉体の発達様式、多年生で分枝したリボン型の成熟前葉体などはすべて、イノモトソウ科・イワガネソウ科・チャセンシダ科などには見られないことで、ウラボシ科の方とよく一致する。なお染色体や幼葉の性質の研究によって類縁はさらに確立されるであろう。

### 〇ヤマアイの染色性について (渡辺清彦) Kiyohiko WATANABE: Possibility of *Mercurialis leiocarpa* as blue dye in ancient Japan

最近辻村喜一氏が「熊野に自生する山あいを用いた小忌(おみ)の青摺について」と云う、20頁ばかりの小冊子を送って下さった。それは学術論文と云う形のものではないが、ヤマアイについての我々の考を一変させる実験である。ヤマアイがインジゴを含まぬ事は、本誌 44 巻 314 頁に久内清孝氏も書いて居られるし、又昭和 46 年発行の三木産業KKの「阿波藍譜・精藍事業篇」503—512 頁に、戸田隆幸、後藤捷一、安村二郎三氏合著の「内地産山藍は青藍分を含まない—分光光度計による山藍および蓼藍中のインジゴの分析」と云う報文がある。ヤマアイの葉をすりつぶしてその汁を濾紙に滴下すると、葉緑素による色斑の周囲に無色の液のシミが拡がり、暫くしてそれが青色に変る事は周知の事である。またヤマアイの葉緑素を含まぬ白色の地下茎を搾って無色の汁を滴下すると、それも青色に変る事も容易に実験出来る。然しこれは多くは数日のうちに赤変し、且つ水を入れるとこの色は溶け去るので染色性はない。これが欧州の *Mercurialis annua* で *Hermidin* と呼ばれるものと推定されるが、辻村氏によるとこの青変は日光にさらすと著しく進み、数日日光に当たったヤマアイの乾固体を粉末にして、少量の水で(弱アルカリが良いと云う)浸出すると青色液が出来、これで布を染めて銅塩(硫酸銅等)で媒染するとそのまま色が定着し、水で洗っても脱色しない事を報告している。そして氏はこれが古代の山アイの摺染であろうと論じている。我々がヤマアイを扱って特に気づく事は特有の悪臭のある事である。ヤマアイにはインジゴは無いが、アイのインジゴ、クサギのトリコトミン、貝紫のディプロムインジゴ等、インジゴイドが皆悪臭のある事と何等かの関係もありそうに思われる。辻村氏は薬品系統の方であるが、今更第一線に出てヤマアイの化学成分を追及される御意志もない様に思われるので、何方かこの問題を追及して下さる方があればと、紹介する。なお氏は和歌山県田辺市湊三栖口 1580-4、〒646 に住んで居られる。

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